

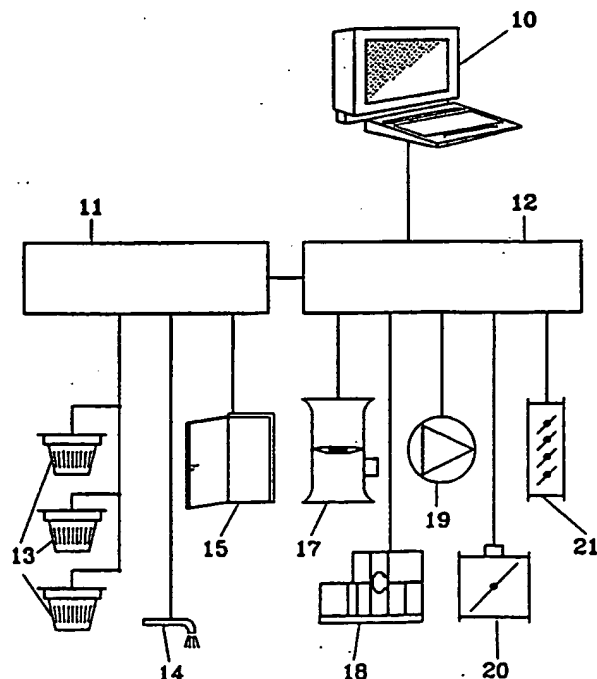


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>5</sup> :</b> <b>B63J 2/02, A62C 3/10</b> <b>F24F 11/00</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 94/10031</b> <b>(43) International Publication Date:</b> 11 May 1994 (11.05.94)
<b>(21) International Application Number:</b> PCT/SE93/00920 <b>(22) International Filing Date:</b> 3 November 1993 (03.11.93) <b>(30) Priority data:</b> 9203299-4                      4 November 1992 (04.11.92)    SE <b>(71) Applicant (for all designated States except US):</b> ABB FLÄKT AB [SE/SE]; S-120 86 Stockholm (SE). <b>(72) Inventors; and</b> <b>(75) Inventors/Applicants (for US only) :</b> GÖTMALM, Örjan [SE/SE]; Östra Björnvägen 3, S-430 41 Kullavik (SE). BERGSTRÖM, Gary [SE/SE]; Bogrens Väg 25, S-439 00 Onsala (SE). <b>(74) Agent:</b> GÖTEBORGS PATENTBYRÅ AB; P.O. Box 5005, S-402 21 Göteborg (SE).		<b>(81) Designated States:</b> AT, AU, BB, BG, BR, BY, CA, CH, CZ, DE, DK, ES, FI, GB, HU, JP, KP, KR, KZ, LK, LU, LV, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, US, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>In English translation (filed in Swedish).</i>

**(54) Title:** SMOKE CONTROL SYSTEM FOR SHIPS**(57) Abstract**

A smoke control system for ships with at least two sections (22, 23), isolated from each other by bulkheads and decks. The system includes at least one fan unit (17; 18), air distributors (20, 21) for supply of fresh-air respective evacuation of consumed air from said sections, ducts (24) that connect the fan unit and the air distributors with each other and at least one fire detector (13) arranged in each section. A release of state of alert via a supervision unit (10) selectively generates a forced flue gas extraction from one or several sections in the ship and increases selectively the atmospheric pressure in other sections. The smoke control system includes extra, normally inactive exhausting points (25) for flue gas, arranged individually or in groups within each section which are selectively possible to activate via the supervision unit (10). The ordinary air conditioning system's flow and pressure in the exhaust air duct are reversed by detection of a state of fire. Flow and pressure in the intake air duct are kept at such levels so that spreading of smoke through them is prevented, from one accommodation to another.



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## SMOKE CONTROL SYSTEM FOR SHIPS

## TECHNICAL AREA

5 The present invention refers to a smoke control system for ships with at least two, by bulkheads and decks, from each other isolated sections, which system includes at least one fan unit, air distributors for supply of fresh-air respective evacuation of consumed air from said sections, ducts that  
10 connect the fan unit and the distributors with each other and at least one fire detector arranged in each section. The invention also includes a procedure for fire-fighting on board ships.

## 15 BACKGROUND OF THE INVENTION

A fire on board a passenger ship often causes that many people are exposed to mortal danger. Unless the seat of fire can be fought immediately in a successful way, large quantities of poisonous and hot smoke will be produced. Evacuation of  
20 passenger must take place very quick and effective, so that they will not be injured by the smoke.

On board a passenger ship, 158 people were killed in 1989 in a fire. Almost all these people were killed due to inhalation  
25 of hot, toxic gas. This gas makes it difficult to find evacuation ways and also makes the attempts to reach and fight the seat of fire more difficult.

The progress in the area of fire safety on board ships move in  
30 direction of making the sprinkler systems more effective, so that these better manage to fight a fire.

However, fires occur that are the works of incendiaries on board passenger ships. In such cases there is a risk that the  
35 sprinkler nozzles near the fire are sabotaged. If the fire is produced by means of an inflammable liquid, the sprinkler system's capacity to put out the fire is also reduced.

## THE TECHNICAL PROBLEM

The purpose of the present invention is to provide a control system that actively can prevent the spreading of combustion gases in ships.

5

## THE SOLUTION

For this purpose the device according to the invention is characterized by means for selective generation of a forced flue gas extraction from one or several sections in the ship, and means for an selective increase of the atmospheric pressure in other sections. The procedure according to the invention is characterized in that the ordinary air conditioning system's flow and pressure in exhaust air ducts are reversed by detection of a state of fire, and that flow and pressure in the intake air ducts are kept at such levels so that spreading of smoke through them, from one accommodation to another, is prevented.

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15

## DESCRIPTION OF THE DRAWINGS

The invention will be described hereinafter with reference to an embodiment that is shown in the enclosed drawings, wherein

- Fig. 1 shows schematically, in block form, a smoke control system according to the invention,
- 25 Fig. 2 and 3 show schematically a passenger ship's dividing into different smoke protection zones and the use of the control system at two different state of fire, and
- Fig. 4 shows in perspective a section through a passenger ship with a smoke control system according to the invention.

30

## DESCRIPTION OF EMBODIMENT

Fig. 1 shows the systems that are parts of a smoke control system according to the invention, that are supervised by an control unit, by means of a display 10 or control panel located, e.g. at the captain's bridge.

35

The sub-systems are divided into two main groups 11, 12, of which the first-mentioned may comprise fire detectors 13, sprinkler systems/alarm sirens 14, fireproof doors 15 and smoke hatches 16, which different sub-systems are normally used for detection of presence of fire and to minimize the damages from a fire. The other group may include flue gas resistant high-capacity fans 17, air conditioning units 18, mechanical ventilation 19, fire- and fluorohalocarbon resin ("Halon") dampers 20 and remote-controlled ventilation distributors 21 for supply of fresh-air respective evacuation of consumed air.

The air conditioning units are connected to the ventilation distributors 20, 21 via separate ducts for intake- and exhaust air.

In its most simple form the smoke control system may include the supervision unit 10, the fire detectors 13, the air conditioning units 18 and the air distributors 20, 21. Thereby the air conditioning units must be provided with protective agents, so that they can resist the hot flue gases during the duration of the fire. These protective agents can for instance include means for injection of a refrigerant, e.g. water or intake of cold air for cooling through air flushing. Besides, heat resistant isolated cables should be used for feeding of electric current and for signal cables.

In case of fire, this smoke control system is controlled (see Fig. 2 and 3) in such a way that the air conditioning units is made to draw air out from the fire protection zone in which the presence of fire has been detected, in Fig. 2 it is in the engine room 22 of the ship, so that a negative pressure arises in this fire protection zone. At the same time the ventilation system in the remaining parts of the ship is short-circuited, so that intake air is supplied both via the intake air duct and the exhaust air duct. Hereby a positive pressure arises in the remaining parts of the ship and the smoke is prevented from being transmitted further from the zone on fire via the

ventilation system to the remaining parts of the passenger ship.

5 Fig. 3 illustrates how a continuous fire in a cabin in another part of the ship, e.g. cabin 23, influences the operation control of the ventilation system.

10 The invention is shown in its most advantageous form with reference to Fig. 4. In this embodiment of the invention the ship has been provided with separate duct systems 24 for evacuation of flue gases. These ducts reach from the damper provided air distributor 25 up to the special high-speed fans 26, encased against heat, for forced extraction of hot flue gases. The ducts 24 extends in the main parallel with the air conditioning units' 18 intake air- and exhaust air ducts 27a  
15 respective 27b, via the next to the stairwell 28 provided vertical trunks 29 to each cabin deck, and to the endings of the passages 30 that connects two nearby stairwells horizontally.

20 In case of fire this smoke control system is controlled so that the ventilation system is short-circuited, so that intake air is supplied both through the intake air duct 27a and the exhaust air duct 27b to other parts of the ship, i.e. also  
25 specially to the zone on fire. At the same time, a negative pressure is generated only in this section by means of the high-speed fans 26.

30 The ducts 24 can also partly be formed of the vertical trunks 29, which simplifies the draw of ducts.

To prevent introduction of smoke from the zone on fire into the stairwell, the stairwell 28 is at the same time put under positive pressure by the ventilation system.

35 Through use of the invention in passenger ships, will it be possible to use the fireproof doors for evacuation of people

and for fire fighting, i.e. the fireproof doors do not need to be locked.

5 The invention is not limited to the above described embodiments, instead more variants are conceivable within the scope of the following claims.

## CLAIMS

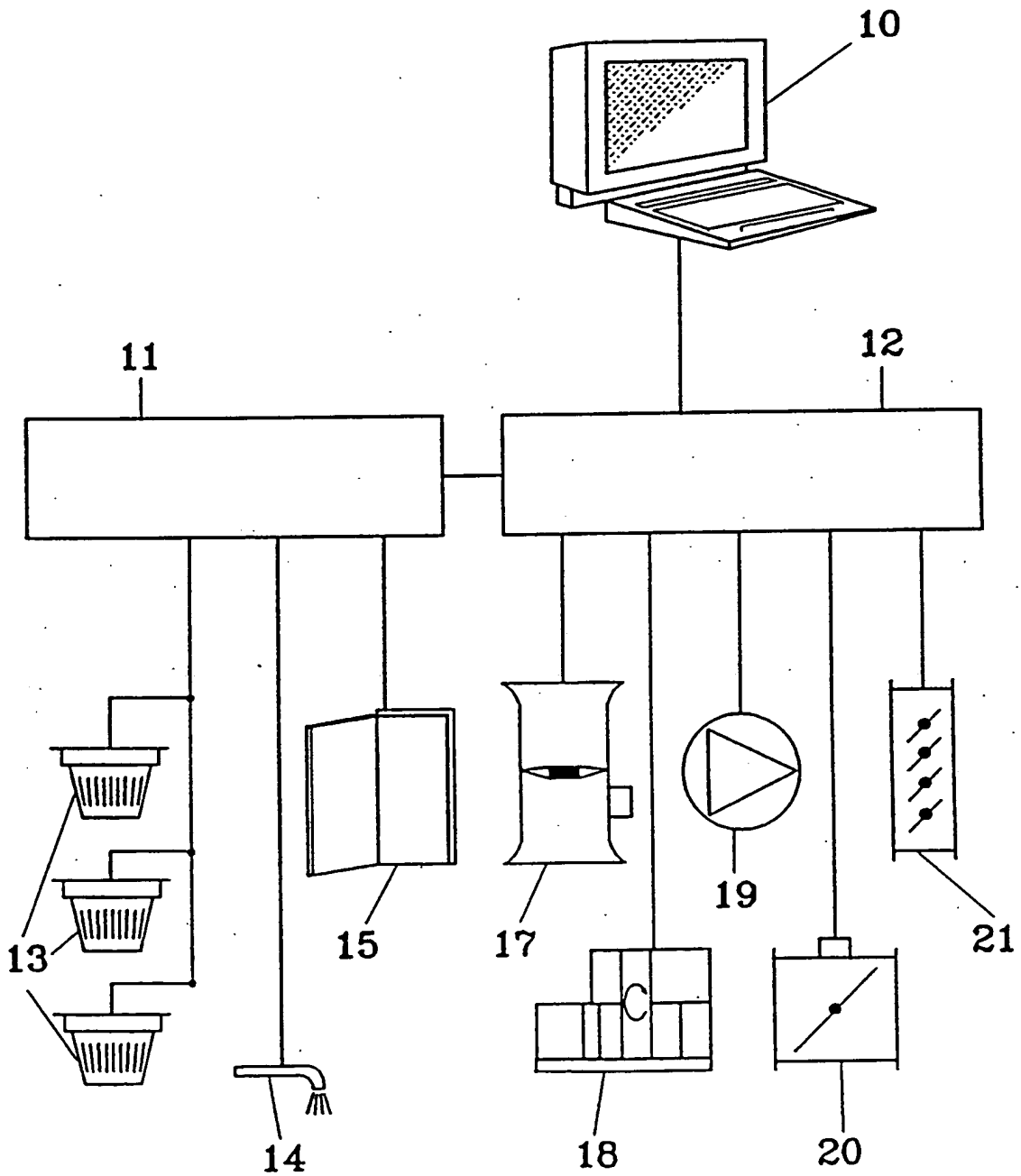
1. Smoke control system for ships with at least two, by  
5 bulkheads and decks, from each other isolated sections (22,  
23), which system includes at least one fan unit (17; 18), air  
distributors (20, 21) for supply of fresh-air respective  
evacuation of consumed air from said sections, ducts (24) that  
10 connect the fan unit and the air distributors with each other  
and at least one fire detector (13) arranged in each section,  
that by release of state of alert via a supervision unit (10)  
selectively generates a forced flue gas extraction from one or  
several sections in the ship and selectively increases the  
15 atmospheric pressure in other sections,  
c h a r a c t e r i z e d i n,  
that the smoke control system includes additional, normally  
inactive evacuation points (25) for flue gas, arranged  
individual or in groups within each section and selectively  
possible to activate via the supervision unit (10).  
20
2. Control system according to claim 1,  
c h a r a c t e r i z e d i n,  
that the fan unit (17; 18) includes means for injection of a  
refrigerant on the fan's intake side.  
25
3. Control system according to claim 1 or 2,  
c h a r a c t e r i z e d i n,  
that the supervision unit (10) communicates with at least one  
flue gas resistant high-capacity fan (17), with mechanical  
30 ventilation (18, 19) and with controllable air distributors  
(20, 21).
4. Control system according to any of claims 1-3,  
c h a r a c t e r i z e d i n,  
35 that the supervision unit (10) communicates with in the ship  
arranged fire detectors (13), sprinkler system (14), alarm

sirens, releasable fireproof doors (15) and smoke hatches (16).

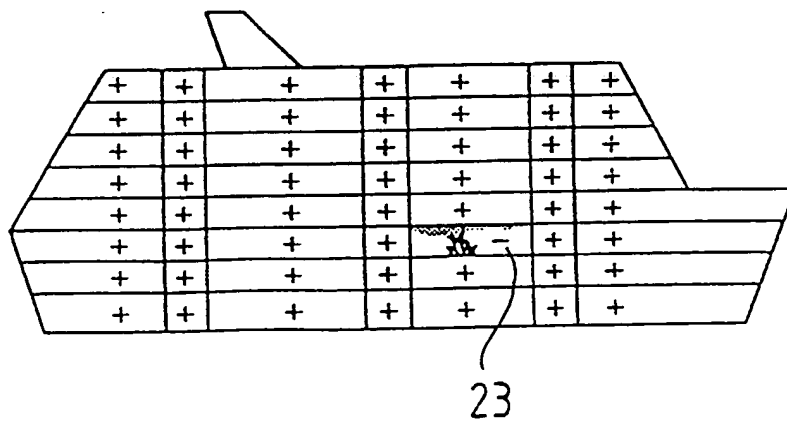
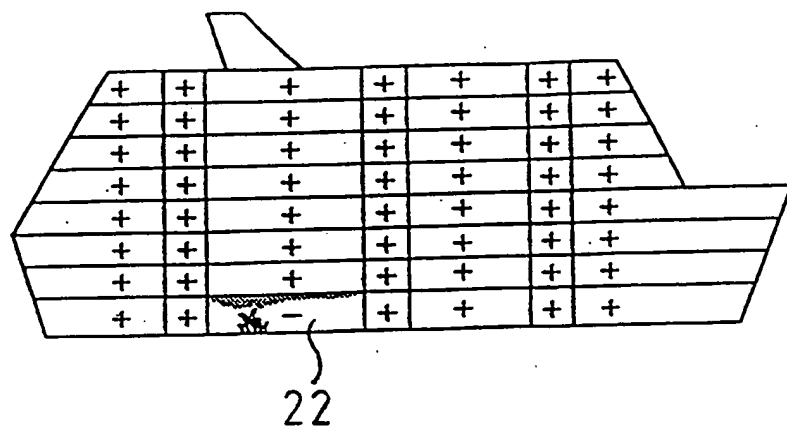
5. Procedure for fire-fighting on board ships with at least two, by bulkheads and decks, from each other isolated sections (22, 23), which ship is provided with a ventilation system comprising at least one fan unit (17, 18) and air distributors (20, 21), which normally are used for supply of fresh-air respective evacuation of consumed air from said sections, and ducts (24, 27) that connect the fan unit and the air distributors with each other, whereby the atmospheric pressure is partly reduced through forced flue gas extraction from the section(s) where the fire has got a grip, and partly is increased in at least the nearest surrounding sections, characterized in,
- 15 that the ordinary air conditioning system's flow and pressure in the exhaust air duct (27b) is reversed by detection of a fire, and that flow and pressure in the intake air duct (27a) are kept at such levels so that spreading of smoke through them is prevented, from one accommodation to another.
- 20
6. Procedure according to claim 5, characterized in,
- that normally inactive exhausting points (25), possible to select individually or in groups, is activated for forcing
- 25 extraction of flue gases from the section(s) the fire has got a grip of.

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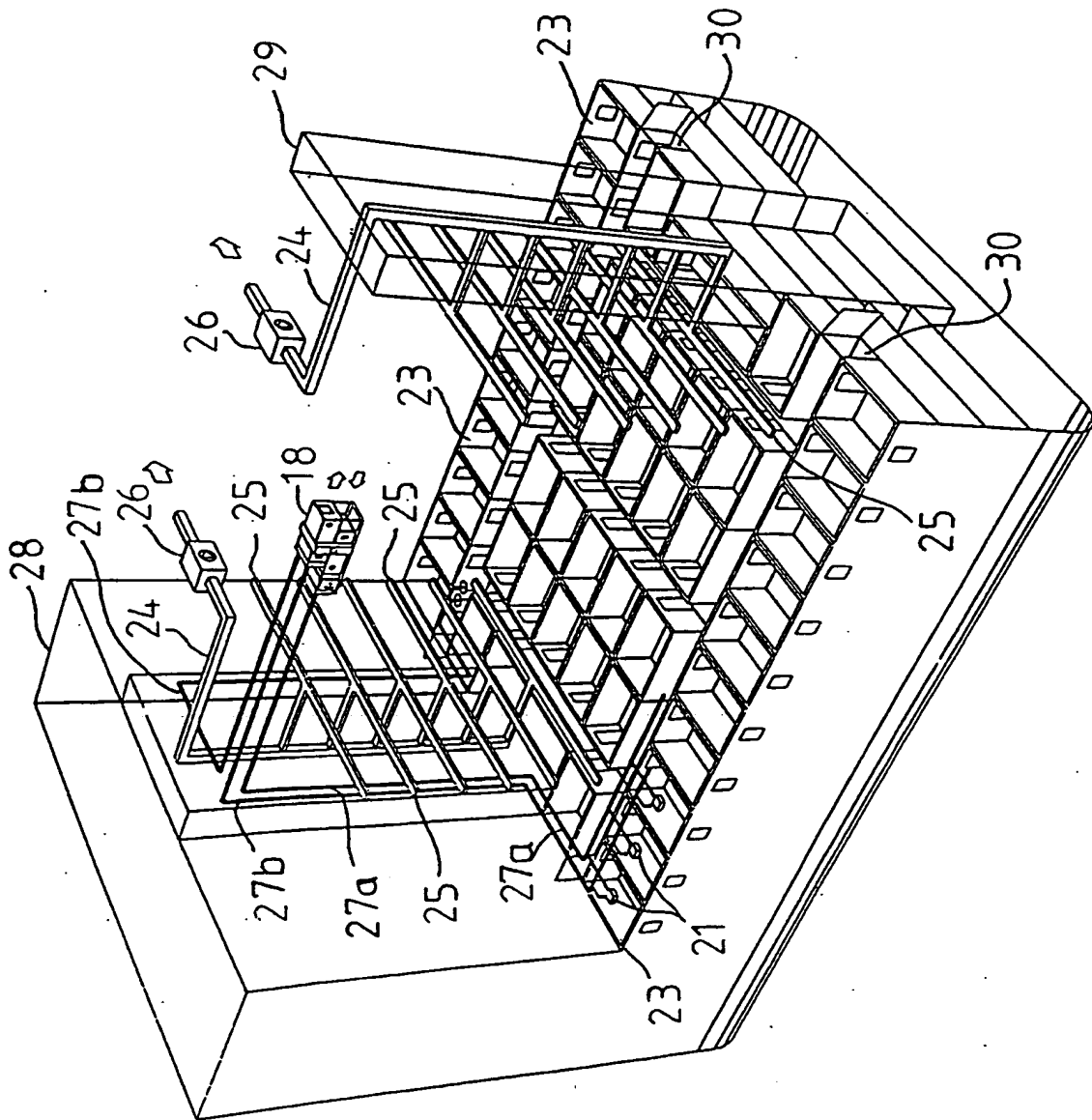
FIG. 1



2 / 3



3/3



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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 93/00920

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: B63J 2/02, A62C 3/10, F24F 11/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: B63J, A62C, F24F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DIALOG:WPI, ORBIT:USPM

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB, A, 2193890 (GEORGE ALFRED FORBES), 24 February 1988 (24.02.88) --	
A	US, A, 4068568 (MOSS), 17 January 1978 (17.01.78) --	
A	US, A, 4765231 (ANIELLO), 23 August 1988 (23.08.88) --	
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☐ Further documents are listed in the continuation of Box C.

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**INTERNATIONAL SEARCH REPORT**  
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A- 2193890	24/02/88	NONE	
US-A- 4068568	17/01/78	DE-A- 2613598 GB-A- 1479793	14/10/76 13/07/77
US-A- 4765231	23/08/88	NONE	
US-A- 4944216	31/07/90	EP-A- 0428108	22/05/91